S. HRG. 98-1075

# VANDENBERG SPACE SHUTTLE LAUNCH COMPLEX

## HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, TECHNOLOGY, AND SPACE

OF THE

## COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

CONSTRUCTION DEFICIENCIES AND QUALITY CONTROL FAILURES, SPACE SHUTTLE LAUNCH AND LANDING SITE, VANDENBERG AIR FORCE BASE

---

SEPTEMBER 10, 1984

---

**Serial No. 98-104**

---

Printed for the use of the
Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE

39-626 O WASHINGTON : 1984

S261-71

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

BOB PACKWOOD, Oregon, *Chairman*

| | |
|---|---|
| BARRY GOLDWATER, Arizona | ERNEST F. HOLLINGS, South Carolina |
| JOHN C. DANFORTH, Missouri | RUSSELL B. LONG, Louisiana |
| NANCY LANDON KASSEBAUM, Kansas | DANIEL K. INOUYE, Hawaii |
| LARRY PRESSLER, South Dakota | WENDELL H. FORD, Kentucky |
| SLADE GORTON, Washington | DONALD W. RIEGLE, JR., Michigan |
| TED STEVENS, Alaska | J. JAMES EXON, Nebraska |
| BOB KASTEN, Wisconsin | HOWELL HEFLIN, Alabama |
| PAUL S. TRIBLE, JR., Virginia | FRANK R. LAUTENBERG, New Jersey |

GERALD J. KOVACH, *Chief Counsel*
RALPH B. EVERETT, *Minority Chief Counsel*

---

SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

SLADE GORTON, Washington, *Chairman*

| | |
|---|---|
| BARRY GOLDWATER, Arizona | HOWELL HEFLIN, Alabama |
| NANCY LANDON KASSEBAUM, Kansas | DONALD W. RIEGLE, JR., Michigan |
| PAUL S. TRIBLE, JR., Virginia | FRANK R. LAUTENBERG, New Jersey |

# CONTENTS


| | Page |
|---|---|
| Opening statement by Senator Gorton | 1 |
| Opening statement by Senator Heflin | 2 |


## LIST OF WITNESSES


| | |
|---|---|
| Aldridge, Edward C., Jr., Under Secretary of the Air Force, Department of the Air Force, accompanied by Lt. Gen. Robert W. Bazley, Inspector General; and Brig. Gen. Donald J. Kutyna, Director of Space Systems and Command, Control, and Communications, Deputy Chief of Staff, Research, Development, and Acquisition | 2 |
| Prepared statement | 11 |
| Questions of the minority and the answers thereto | 16 |
| Beggs, Hon. James M., Administrator, National Aeronautics and Space Administration | 20 |
| Questions of the minority and the answers thereto | 25 |

# VANDENBERG SPACE SHUTTLE LAUNCH COMPLEX

---

MONDAY, SEPTEMBER 10, 1984

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 9:35 a.m., in room SR-253, Russell Senate Office Building, Hon. Slade Gorton (chairman of the subcommittee) presiding.

Staff members assigned to this hearing: Pete Perkins, professional staff member and Marty Kress, minority professional staff member.

## OPENING STATEMENT BY SENATOR GORTON

Senator GORTON. Welcome to this hearing of the Subcommittee on Science, Technology, and Space. Recently allegations have been made concerning construction deficiences and quality control failures at the space shuttle launch and landing site at Vandenberg Air Force Base. The purpose of today's hearing is to better understand the nature of these allegations and to determine whether there is any accuracy in these charges.

Furthermore, this subcommittee seeks to ascertain if the alleged problems, or any other related problems, have had or could have any impact on the space shuttle program.

We hope that these allegations have no substance whatsoever. However, given the magnitude of the space shuttle program and its importance to our Nation's space program, the questions that have been raised by these charges deserve answers and warrant careful study and examination.

The space shuttle completed its 12th mission just 5 days ago and once again demonstrated its truly remarkable capabilities. With each successive shuttle mission, our space program extends the boundaries of our knowledge and reaffirms our position of preeminence in space.

We should not, however, allow the accomplishments of one or more successful missions to lull us into a false sense of complacency. Due to the complexity of the shuttle and its missions, it is imperative that we establish and maintain the highest possible levels of safety and reliability in the shuttle's supporting facilities. In no way can we afford to settle for anything less than a completely secure and dependable shuttle program.

I am pleased that Under Secretary Aldridge and an Air Force inspector general team have taken immediate action to investigate the shuttle launch and landing site at Vandenberg. If there is any substance to the allegations or if there are any other questions of safety or reliability, this subcommittee and the Congress expect to be kept informed on a regular and timely basis.

I appreciate that our witnesses here today have been able to accommodate the subcommittee on such short notice. We look forward to the testimony of all of you and to your responses, and hope that today's hearing will give the public and the Congress a greater level of confidence in the shuttle project at Vandenberg Air Force Base.

I have an opening statement from Senator Heflin that he asked to have included in the record.

[The statement follows:]

OPENING STATEMENT BY SENATOR HEFLIN

Mr. Chairman, first of all, let me compliment you for the timely manner in which this hearing was put together. As always, you are one step ahead of the pack!

Next, let me associate myself with your opening remarks and the serious nature of today's oversight hearing. The space shuttle program is not only the backbone of this Nation's civilian and military space program, but it is the symbol of this Nation's technological might. Any accusation concerning the integrity of the space shuttle program must be thoroughly evaluated, especially when those accusations are levied by members of the government's quality assurance team.

I must admit that I was deeply concerned when I heard the extent and nature of the allegations reported by NBC News. It is one thing to have to go home to your constituents and contend with scheduling delays and cost overruns, it is quite another to have to deal with accusations that a program is "an accident waiting to happen" and "there are such technical problems that it could result in the shuttle blowing up upon liftoff."

Mr. Chairman, it is with great interest that I await the testimony of Under Secretary Aldridge and Administrator Beggs as to the extent of the problems at the Vandenberg space shuttle complex, the scope of actions that have been taken to address these concerns, and how, if at all, these problems will affect the scheduled launch of the space shuttle Discovery in October 1985.

In addressing these concerns, I also hope Under Secretary Aldridge will provide for the Committee a summary of the findings of the Inspector General's investigation and a detailed description of the steps that have been taken to ensure a significantly higher degree of quality control at the Vandenberg complex.

Mr. Chairman, I know I speak for all the Members of the Committee and for the American public when I say that we are tired of reading about the lack of quality control and the lack of quality goods and services being obtained by the Federal Government. I would hope in the case of the Vandenberg space shuttle launch complex, that after a frank and open discussion today of the issues and concerns, the Members of the Committee and the American public will be assured that the task at hand will be completed successfully, safely, and economically.

Senator GORTON. With that, we will begin with Secretary Aldridge and those who are accompanying him. Sir, you may proceed.

**STATEMENT OF EDWARD C. ALDRIDGE, JR., UNDER SECRETARY OF THE AIR FORCE, DEPARTMENT OF THE AIR FORCE, ACCOMPANIED BY LT. GEN. ROBERT W. BAZLEY, INSPECTOR GENERAL; AND BRIG. GEN. DONALD J. KUTYNA, DIRECTOR OF SPACE SYSTEMS AND COMMAND, CONTROL, AND COMMUNICATIONS, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT, AND ACQUISITION**

Mr. ALDRIDGE. Mr. Chairman, I welcome the opportunity to appear before this committee to discuss the Vandenberg Air Force

Base shuttle launch and landing site. I have a prepared text which is somewhat lengthy, so I will insert that for the record with your approval.

Senator GORTON. We will include it in the record as if read.

Mr. ALDRIDGE. I plan to summarize that statement to you this morning. I have also provided the committee the latest photographs of the status of the Vandenberg Air Force Base launch construction site there for the shuttle.

I am accompanied this morning by Lt. Gen. Bob Bazley, inspector general of the Air Force, and Brig. Gen. Don Kutyna, the Director of Space Systems and Command, Control, and Communications.

As a result of the allegations that there was a quality control problem at Vandenberg, the Secretary of the Air Force, Verne Orr, asked that I go to Vandenberg to investigate the substance of these allegations. In addition to my personal review, an Air Force inspector general team was dispatched to conduct an even more complete review of the situation and to focus on any specific items uncovered during my review there.

On August 23, I went to Vandenberg to discuss the status of the launch site construction deficiencies, procedures for closing out deficiencies, contractor relationships, and the substance of the specific allegations of safety problems. In addition, I held personal discussions with the quality assurance group leadership as to the motivation of those individuals who apparently felt their concerns with Vandenberg's safety were not being adequately resolved.

I personally observed each of the specific problems on the launch pad which were referred to in the news broadcast.

Let me assure you and emphatically state that there is no substance to any of the allegations that the launch pad will blow up when the shuttle is launched from Vandenberg next year. While we have identified deficiencies in the construction that could, if not corrected, cause significant safety problems, there is no fundamental problem of safety or quality assurance at Vandenberg which would prohibit us from successfully and safely launching the shuttle.

There is no doubt that we have a tremendous technical and management challenge to complete Vandenberg on time and to launch the shuttle Discovery on October 15, 1985. Our management procedures for detection and resolution of problems are sound and will permit us to meet that challenge.

To illustrate this point, all of the deficiencies mentioned in the broadcast were identified by either contractor or Government personnel onsite. It was our own management system which uncovered every one of these problems.

Our problem reporting and accounting system is a time-tested system which has led to the impressive success rate in launching our Titan and Atlas space launch vehicles, as well as the space shuttle on the east coast. We are not new to this business, and we have a strong management system in place to ensure that safety and mission success will never be jeopardized. And incidentally, such problems are not unexpected in a project as complex as Vandenberg, and are consistent with NASA's experience at the Kennedy Space Center.

We will continue to identify and solve problems as we get closer to October 1985. We will not launch from Vandenberg until all these problems are solved to the satisfaction of the construction contractors, the activation contractors, the Government site activation personnel, the shuttle processing contractor, NASA, and the Air Force operators.

There will be numerous tests performed on all systems before we are prepared for launch. No launch will occur until all individuals and organizations are convinced that we can launch the shuttle successfully and safely. We will never compromise personnel safety or mission success to maintain the schedule.

We have identified about 6,000 construction discrepancies at Vandenberg. Most of these are classified as minor, that is, things such as a blown fuse, a loose bolt, a jack which needed grease, or a bad switch. It is important to note, however, that our management system does prioritize the discrepancies to ensure that the most serious ones receive attention first.

Of the serious category, out of all 6,000 discrepancies to date, about 60 serious ones were identified. Of these 60, 14 remain to be corrected, and they are all being worked. Each of the allegations made on the news broadcast has been dealt with in detail in my written statement. But I would like to review two of those as examples.

First, the defective welds. Welding stainless steel is a difficult task, and a rejection rate of about 10 percent is normal in an environment like Vandenberg. At the launch pad at Vandenberg, there were 8,000 welds, ranging from pipes of less than an inch in diameter to about 16 inches. Thus we would expect about 800 of those welds to be defective and require rewelding.

The fact is about 700 of the welds were defective. So what was the problem? The problem was that of documentation. Each of the welds must be verified through a radiograph or x ray picture which will reveal any cracks or gaps.

The subcontractor's problem was that the traceability of his radiographs back to the specific welds did not permit us to positively identify which welds were good and which welds were bad on 3,000 of the 8,000 welds. Thus, a complete review of the weld documentation confirmed that of the 8,000 welds in question, 5,000 were good. The remaining 3,000 were re-x rayed, and less than 700 required rework.

The subcontractor who did the welds and performed the radiographs started welding in May 1983. Martin Marietta, the prime contractor at Vandenberg, examined the first of the radiographs in late December 1983. At that time our contractor and Government personnel first questioned the ability of the Martin subcontractor to successfully complete his subcontract.

In March 1984 we recognized that the weld traceability documentation problem was severe and that firm action was required to ensure that our weld integrity was adequate. Martin's initial approach, with Government agreement, was to assist the small business subcontractor to resolve the problem.

The contractor arrangements were changed in April 1984 to permit additional Martin and Government engineers, managers and inspectors to work on the problem. Because the subcontractor

performance did not improve sufficiently, Martin terminated this contract on May 9, 1984, and immediately hired another subcontractor to complete the work.

All 700 defective welds have been corrected, inspected, and certified acceptable by detailed 100 percent inspection certification systems. As part of this problem resolution, we conducted a thorough review of our welding specifications to ensure that they were adequate. In this review, cryogenic experts from NASA, the Air Force, the Aerospace Corp., and the Martin Marietta Corp., have independently verified the adequacy of the specifications. The welding problem is resolved and we will be back on schedule in October 1984.

The second example I would like to discuss is the assertion that the whole pad would blow up because it was wired out of phase. As in other large construction projects of this type, we have found instances of wiring errors. These errors were discovered in our normal testing that follows every electrical wiring project.

In every instance when a wire error is found, a detailed analysis is conducted to determine the best way to fix it. The fix is identified and tracked until it is properly completed and rechecked. All installed wiring at space launch complex 6 will have been checked prior to first launch.

Those discrepancies we have uncovered thus far have been fixed in accordance with accepted aerospace industry practices or are currently in the process of being fixed. The entire investigation I conducted at Vandenberg showed that we are doing a tough, complex job and we are doing it well. There are certainly problems. We expected them. But we are finding them and fixing them.

In fact, I would be more concerned if we were not identifying problems. However, do not let me mislead you to think that the hard part of the task is behind us. We have even a more difficult and complex task ahead of us. Before we ever handle a shuttle orbiter, we have many ground system tests where we will test each component by itself to ensure it works. Then we will conduct integrated system tests to make sure subsystems and then the complete systems work as they are supposed to.

Only then will we test against a real orbiter. But even then, the first orbiter that we will use in our tests is a nonflight orbiter, Enterprise, the orbiter 101. The first space flight orbiter that we will process will be Discovery, orbiter 103, which has made a successful flight test. And before we process Discovery, NASA will have checked it out thoroughly at the Kennedy Space Center so that we can be sure we have a good vehicle prior to our testing. Then if any problems are noted we can isolate the problems quickly.

All of this adds up to more discrepancies than the 6,000 we have identified to date. We know we will have many more before we are done with the rigorous systems of checks upon rechecks prior to launch. Most of these will be in the minor category. A few will be serious.

But I assure you, each and every one of them will be worked off and corrected before we attempt to launch. We will not sacrifice safety and mission success.

The story at Vandenberg, as I found out, is a real success. It is tough and it is challenging, but it is a success-oriented, dedicated,

can-do outfit, and one we should all be proud of. I am satisfied that the program has gone well, but let me assure you this subject will continue to receive my personal attention.

Finally let me say that the Air Force appreciates the quality assurance personnel at Vandenberg Air Force Base and throughout the Air Force, and the difficult and essential job that they do. We are concerned about the frustration level that must have existed in these individuals who felt they must go to the media to get their views heard, as opposed to using the existing system to resolve their concerns.

Let me emphasize that we are not interested in who these individuals were, but we were very interested in assuring that our existing management system is working properly and promptly and effectively to resolve the problems we have identified.

The Air Force inspector general has completed a detailed investigation, which has uncovered no additional major findings. However, both reviews did uncover some concerns that need to be resolved at Vandenberg. Those included the number of quality assurance personnel on site and the communications between our quality assurance personnel and the site activation managers. We are taking steps to solve those problems.

In summary, let me say we have a tough challenge at Vandenberg, but I believe we have the management procedures in place to complete the job successfully and safely.

This concludes my formal statement, Mr. Chairman. I will be glad to answer any questions that you may have.

Senator GORTON. Thank you, Mr. Secretary.

According to your testimony, the Air Force inspector general has completed its investigation of the Vandenberg shuttle launch complex and uncovered no additional major findings of defects. Could you describe to us the nature and the scope of the investigation? How broad was it?

Mr. ALDRIDGE. Yes, sir. But I think I had better let General Bazley answer that. He was the head of the inspector general team.

General BAZLEY. At the direction of the vice chief, in the chief's absence, Mr. Chairman, we put together a team, a tailored team of technicians and investigators, and our charter was to look very closely at the allegations, and a team was tailored accordingly of about 13 different kinds of people—engineers, contractual kinds of people, quality assurance people.

The team included a representative of the U.S. Army Corps of Engineers, who had a responsibility for basic construction at complex 6. The team was in place at Vandenberg. I personally was there for 4 days. Brigadier General Johnson was my deputy, who was also there for the full time.

We did an indepth investigation of all the allegations over a period of about 13 days, a team of 13 people.

Senator GORTON. You are satisfied that that was a broad and deep enough investigation to discover any discrepancies?

General BAZLEY. We are very satisfied, Mr. Chairman. The primary effort was certainly not to do a witch hunt. That was not our mission. We wanted to determine if there were any serious facts to the allegations, because safety is a primary interest.

One of the members of thc team was in fact an industrial safety engineer, a member of my safety staff, along with a quality assurance expert. We did a thorough shakedown. The primary modus operandi of the investigation was to get the people to come forward and talk to us. I personally met with all members of Government quality assurance people in about a 3 hour and 15 minute session, where we opened the doors.

We also provided an opportunity for those people to come to us individually, which they did. That kind of testimony is clearly shown in the investigative report.

Senator GORTON. Mr. Secretary, according to your testimony, you identified some 6,000 discrepancies at the launch and landing site at Vandenberg, and categorized 60 of those as serious. You indicated that the Air Force has corrected all but 14 of the serious discrepancies.

Will the resolution of the remaining 14 serious discrepancies impact the readiness of the project relating to the October 1985 launch?

Mr. ALDRIDGE. No, sir, we do not believe they will. Right now we are still on for October 15, 1985, as our launch schedule. As we have gone through these problems, the margin that exists in the launch date is being eroded slowly, but we do not believe any of those are the type of problems that would be the show-stoppers that would require us at this point to reassess the launch schedule.

This does not mean, however, as we continue to work up toward October 15 next year, when we get the orbiter Enterprise on the pad and begin checking out some of the major subsystems, then of course get Discovery on the pad in May of next year, problems could continue to pop up which could force us to reassess.

Senator GORTON. In other words, it is for all practical purposes inevitable that there will be additional discrepancies?

Mr. ALDRIDGE. Yes, sir.

Senator GORTON. And that some of those will be serious and will have to be dealt with at the time?

Mr. ALDRIDGE. Yes, sir. In fact, I would be very much concerned, as I mentioned, if we did not identify problems such as this as we proceed.

I think it is a very complex undertaking that we have out at Vandenberg, but I think right now we have no basis to reassess or change our schedule I think we are tracking along, so long as there is not any major problem that would occur between now and then.

Senator GORTON. Are you confident that your inspection system discovers all serious discrepancies?

Mr. ALDRIDGE. Yes, sir. That was one of the major findings of my review, that every one of the discrepancies that were found were found by our people, the contractors, or the Government personnel themselves. That was another concern, that when they went out there it was alleged, or one could interpret, that the problem at Vandenberg was that we were covering up problems that may have existed in quality or safety.

I found that to be completely erroneous. We were in fact identifying every single problem that was coming up. Our contractors and our Government personnel are not bashful in identifying those

problems, and our site activation task force managers are very aggressive in trying to resolve them.

Senator GORTON. How can we interpret the 6,000 discrepancies, with 1 percent of them being serious discrepancies, in connection with a project of this nature? How does it compare with earlier construction of similarly complex space activities? Is there some kind of industry average?

Mr. ALDRIDGE. I tried to get an answer to that question. Unfortunately, there is only one project that perhaps is similar to that particular project, and that is the construction of the shuttle launch complex at the Kennedy Space Center.

We have NASA personnel at Vandenberg helping us for the activation of the site. I tried to ask them, is 6,000 a reasonable number, is it too high or is it too low? And while it is difficult to measure that particular parameter, the NASA people at Vandenberg told me that that number was probably about right.

They used a number that at this point in the Kennedy launch construction was around 10,000. I understand that NASA says that number is probably a little high. But if it is in that order of magnitude, I think some standard measure would say that we are probably about right in that number of discrepancies.

Incidentally, Mr. Chairman, I did not identify the 6,000. All 6,000 of the discrepancies were identified by the site activation personnel. They have a list. They worked off all but about 2,400 of the 6,000, of which 60 were in the serious category, and now we have worked down to about 14 of those in the serious category.

Senator GORTON. According to the Army Corps of Engineers, the initial launch capability date for complex 6 at Vandenberg has already been moved back twice. Its original date was December 1983, which was first slipped to October of this year and then to October of next year.

Can you explain the circumstances which necessitated the repeated slippage of this date, and tell us what impact such delays have on our general space program readiness?

Mr. ALDRIDGE. Yes, sir. The original date was December 1983 and that was picked because of the critical nature of trying to launch national security payloads out of Vandenberg. But as we know, as we went through the development of the shuttle, we have found necessity to make changes to some of the launch complex equipment at Vandenberg.

This is inevitable. As we were developing the shuttle, we saw the need to make Vandenberg consistent with the changes that were being implemented at the Kennedy Space Center. In 1981, I believe was the date when I first got involved with Vandenberg, when we looked at the schedule and the cost and all the changes that needed to be made, we made a decision to slip it to October 1985 because we did not believe we could put all the pieces together and have it checked out and be acceptable to us. So we slipped the date to October 1985.

The impact that has on our program is we continue to have to fly expendable launch vehicles out of Vandenberg for a longer period of time for those critical national security payloads. It just delays the time in which we can implement the shuttle for that program.

But right now, October 1985 is an acceptable date to us, and as far as I can see it will have no major impact on our space program.

Senator GORTON. You are still aiming for October 1985?

Mr. ALDRIDGE. Yes, sir, October 15.

Senator GORTON. But you are not going to utilize the October 1985 date unless you are convinced that the facilities are in perfect condition?

Mr. ALDRIDGE. No, sir. The Air Force is not in the business of launching space boosters that we feel would be launched unreliably or unsafely.

Senator GORTON. According to a July 20 Air Force report on defective welding allegations, one conclusion concerning the welds at space launch complex 6 was that "the problems of poor weld quality and poor radiograph traceability were allowed to go undetected for over 1 year because of virtually no organized and effective quality control by the subcontractor over the work performed and by virtually no quality control surveillance by the contractor or the Air Force."

You did, at least in your written testimony, describe that to a certain extent. But I would like to know whether you agree with this assessment and, if so, whether or not the Air Force is now performing adequate quality control surveillance.

Mr. ALDRIDGE. Yes, sir. I mentioned before that, with great hindsight, we probably should have picked up on the quality problem of the welds a little bit earlier. Martin Marietta also agrees with that.

However, when you go back and look at the situation that did exist, the welds started at Vandenberg in May 1983. An approved subcontractor, the small business firm which did perform the welds, in fact began the x ray of the welds at that time. The problem was that the actual x rays were not reviewed in detail by Martin until November or December 1983.

When you look at any construction project such as this, Martin Marietta is managing 80 subcontractors on that particular construction pad, and they obviously have to allocate their priorities according to those things which they feel are more important and could in fact seriously affect the launch schedule.

One of those typically was the launch mount stiffness that was being worked, because we were moving from a steel case to a filament wound case for the solid rocket boosters. Those are examples of allocation of resources. But in hindsight, we should have been watching that problem earlier.

We have now resolved the problem. The welds have now been fixed. They are now undergoing tests, and I believe the number is something on the order of 16,000 particular welds throughout the site, of which 8,000 were the subcontract welds.

We have tested 60 percent of those welds so far in our test program and we have had no failures. So I think it is indicative that our problems are behind us with regard to the weld problem.

Senator GORTON. Is the subcontractor to which this quote refers one of those which have been replaced?

Mr. ALDRIDGE. Yes, sir, the contract was terminated and it was replaced by Bechtel, which is now the subcontractor to Martin.

Senator GORTON. According to this same report, of the 8,000 welds—and I think you just spoke of them—on the space launch

complex 6 piping, approximately 25 percent were not marked with a welder's identification number, as required by the specifications. Is that an acceptable number of unmarked welds, and if not what has been done to improve the documentation?

Mr. ALDRIDGE. No, sir, that was not an acceptable number of welds. I think that was indicative of the problem that the subcontractor had. It was not so much with the quality of the welds; it was his management system for maintaining the traceability of the welds and the x rays and the testing procedure.

The subcontractor was provided help during the April timeframe in 1984 to get that problem resolved, and it was apparent from Martin that he could not perform the task and that is why the contract was terminated. When Bechtel came onboard, all of that has been put back into order again, and I think we are behind that problem at this point.

Senator GORTON. The report indicates that the subcontractor in question began that work in February 1983. The report indicates that before March 28, 1984, the subcontractor had no certified weld inspectors on the job and had not accomplished or organized an effective quality control of the welding.

Should the Air Force have been aware of these problems before the investigation which led to this report?

Mr. ALDRIDGE. Yes, sir. I believe this is one of those indications that, with hindsight, we should have been on top of that problem a little earlier. However, the Air Force looks upon the prime contractor as its agent for carrying out its responsibilities, and the prime contractor, with its quality assurance people, we look toward them as being the responsible agent for us.

In this particular instance, Martin should have been on that problem a little bit earlier. We should have identified it a little earlier ourselves.

Senator GORTON. Is the financial as well as the physical responsibility for all discrepancies found basically that of the prime contractor within the contract price?

Mr. ALDRIDGE. Yes, sir. It is our view that he is responsible for the correction of any deficiencies found within the contract price. And this particular contract is a cost-plus contract. The issue there is, if he has to go back and correct any of those problems, is it the responsibility of Martin to do the correction within the same dollar amount or should he charge us the cost to perform those deficiencies?

Our position right now with Martin Marietta is that Martin is responsible for those costs incurred as a result of fixing the contract.

Senator GORTON. And so, it does not add to your costs or to the plus?

Mr. ALDRIDGE. That is our position. However, I am sure that Martin disagrees with that position at this point.

Senator GORTON. Mr. Secretary, I thank you for your testimony and for your help this morning, and also General Bazley and General Kutyna. Thank you very much.

Mr. ALDRIDGE. Thank you, sir.

[The statement follows:]

STATEMENT OF EDWARD C. ALDRIDGE, JR., UNDER SECRETARY OF THE AIR FORCE

Mr. Chairman and members of the committee: I welcome this opportunity to address your committee and discuss the Vandenberg Air Force Base Shuttle Launch Site (VLS).

As a result of allegations that there was a quality control problem at the VLS, Secretary of the Air Force, Verne Orr, asked that I go to Vandenberg to investigate the substance of these allegations. In addition to my personal review, an Air Force inspector general team was dispatched to conduct an even more complete review of the situation and focus on any specific items uncovered during my review.

On August 23, 1984, I went to the VLS to discuss the status of the launch site construction, procedures for identifying construction deficiencies, procedures for closing out deficiencies, contractor relationships, and the substance of the specific allegations of safety problems. In addition, I held personal discussions with the quality assurance (QA) group leadership as to the motivation of those individuals who apparently felt their concerns with VLS safety were not being adequately resolved.

I personally observed each of the specific problems on the launch pad which were identified in the news broadcast.

Let me assure you and emphatically state that there is no substance to any of the allegations that the launch pad will blow up when the shuttle is launched from Vandenberg next year. While we have identified deficiencies in the construction that could, if not corrected, cause significant safety problems, there is no fundamental problem of safety or quality assurance at Vandenberg which would prohibit us from successfully and safely launching the shuttle.

There is no doubt that we have a tremendous technical and management challenge to complete the VLS on time and to launch the shuttle, Discovery, on October 15, 1985. Our management procedures for detection and resolution of problems are sound and will permit us to meet the challenge.

To illustrate this point, all of the deficiencies mentioned in the broadcast were identified by either contractor or Government personnel on site. It was our own management system which uncovered every one of these problems!

Such problems are not unexpected in a project as complex as the VLS and are consistent with NASA's experience at the Kennedy Space Center. In fact, we have identified some 6,000 discrepancies, most of which are considered minor. Actual examples of minor discrepancies include a blown fuse, a loose bolt, a jack which needed grease, and a bad switch. Of the 6,000 discrepancies, about 60 would be categorized as "serious." We have corrected all but 14 of the ones in the "serious" category. Liquid oxygen tank and valve contamination would be an example of a serious discrepancy. We will continue to identify and solve problems as we get closer to October 1985.

We will not launch from Vandenberg until all of these problems are solved to the satisfaction of the construction contractors, the Government site activation personnel, the shuttle processing contractor, the activation contractor, NASA and the Air Force operators. There will be numerous tests performed on all systems before we are prepared for launch. No launch will occur until all individuals and organizations are convinced that we can launch the shuttle successfully and safely. We will never compromise personnel safety or mission success to maintain schedule.

Next, let me address each of the problems in detail which NBC alleged were being overlooked or were not being corrected.

First, it was stated that, "Air Force inspectors who know the quality of the work say the chances are one in five that it will blow up when they try to launch the shuttle."

The design, activation and check-out of the space shuttle launch facilities at Vandenberg are patterned after, and in some cases identical to, our experience with expendable space launch vehicles and NASA shuttle launch facilities at Kennedy Space Center. The facility design has been subjected to a detailed review process by Air Force and NASA experts. Our activation and check-out teams are using procedures that are patterned after those that have proven successful by NASA for the Kennedy launches and by the Air Force for their successful space and ballistic missile launch programs. The Government activation, check-out and launch team is composed of people with prior experience on the space shuttle activation, check-out and launch at Kennedy Space Center. The prime installation and activation contractor at Vandenberg, the Martin Marietta Corporation, has provided much of the space shuttle check-out equipment being used successfully by NASA at Kennedy now. Martin is also the prime contractor who activated the Peacekeeper processing and launch facilities at Vandenberg and has launched five out of the five Peace-

keeper test shots. This is the same division of Martin that has compiled an outstanding Launch success record for our Titan space launch vehicles.

"Discovery", the first orbiter to fly from Vandenberg will have already been flown by NASA from Kennedy Space Center and will be checked out at NASA prior to shipment to Vandenberg. So, we know that we will have good flight hardware for our first launch from Vandenberg. The stresses experienced by the launch pad facilities at Kennedy Space Center have been thoroughly measured and analyzed. This experience has been applied to our launch facilities at Vandenberg to insure that all the launch pad structures and supporting systems have been designed with adequate safety margins. After completion of the activation phase that we are in now, all systems will be thoroughly checked out in a safe configuration to verify that we are ready to launch. Thus, I conclude that our probability of a fully successful first launch of the shuttle from Vandenberg is fully consistent with the success rate that NASA has achieved at Kennedy Space Center. This conclusion is based on the factors that I have just outlined:

Facility designs based on proven NASA and Air Force practices.

Detailed reviews by NASA and the Air Force.

Experienced Government personnel involved in the activation and check-out process (both NASA and Air Force).

A prime contractor with a proven record in shuttle and expendable space launch vehicles.

Contractor personnel with extensive experience in space and ballistic missile activation and launch programs.

A comprehensive check-out and verification test program for all flight hardware processing and launch facilities at Vandenberg.

Next, NBC news was told that, "everybody within the area of the launch pad would be killed."

A primary objective of the design, construction and testing of a launch complex is to eliminate every possible source of malfunction which could cause fires, explosions, or toxic material spills during launch preparations or the launch itself. Our safety standards are the most stringent that we know how to devise. We have never compromise them and we will. Still, after we have taken all known safety precautions, a space launch is a hazardous operation. Only absolutely essential launch team members are allowed on the launch pad during launch preparations. At time of launch no one is allowed on the pad. The only people allowed within 8,000 feet of the vehicle during launch are those essential personnel who are in the launch blockhouse. The entire pad area has been built to withstand a worst case catastrophic failure without loss of life. The flight crew emergency sidewire and bunker system is the same as that used by NASA at Kennedy Space Center.

The third allegation was, "the entire pad is wired out of phase."

As in other large construction projects of this type, we have found instances of wiring errors. These errors were discovered in our normal testing that follows every electrical wiring project. In every instance when a wiring error is found, a detailed analysis is conducted to determine the best way to fix it. The fix is identified and tracked until it is properly completed and rechecked.

If construction or installation deficiencies are found, the appropriate contractor is required to accomplish repair when it is determined that the action is in the Government's best interest. All installed wiring at the space launch complex six will have been throughly checked prior to first launch. Those discrepancies we have uncovered thus fair have been fixed in accordance with accepted aerospace industry practice on are currently in the process of being fixed.

By the way, the valves referred to on the broadcast, which indicated they might open instead of close, causing a catastrophic failure, are not operated with alternating current (AC) which is subject to wiring phases. All electrically-operated valves on the shuttle launch complex are operated by DC or single phase AC power which are not sensitive to phasing. Thus, the problems found would not have affected valve operation nor endangered the pad or shuttle.

In addition, the operation of every valve will be checked out thoroughly to insure that it operates properly prior to its use in the launch processing system. This is consistent with our practice of verifying the proper operation of all systems using carefully written and reviewed procedures prior to the start of any launch activity.

Next NBC news was told of "contamination of 5 valves."

Preventing contamination of valves and piping on any launch complex is a tough, never-ending job. It is something that we continually contend with even on our space launch pads that have been operational for many years. Avoiding contamination in a construction environment is virtually impossible: especially one of the size and complexity of our shuttle launch facility at Vandenberg. The dust, dirt, sand

and salt air environment is an extremely severe one in which to control contamination. Contamination in the five valves mentioned in the NBC report was discovered by our activation teams during a routine check prior to connecting the 350,000 gallon liquid oxygen storage tank to the newly installed piping system. The valves in question were installed in mid 1982, one year after the liquid oxygen tank was built. As a result of finding this contamination, we are completely re-cleaning the valves and the liquid oxygen tank. We suspect that the contamination resulted from a combination of unusual exposure to the Vandenberg construction environment for over 2 years and from some deficiencies in the original cleaning process. This is just one example of the many contamination issues we will work in detail prior to first launch. The exacting standards of the space shuttle are difficult to meet but we have implemented a rigorous process to be absolutely sure that all these standards are fully met before we proceed into the actual launch processing. I have reviewed this process and am confident that it is a good one. This particular problem was found early in July 1984 and is being corrected using this system.

A related contamination problem was over "fluid droplets" and "liquid in the cables between the command center and the launch pad."

In April 1984, the vendor of a special cable used to transmit payload status to the launch control center found some unexpected moisture in raw cable stock in his plant. This was an isolated case at the contractor's plant, not a problem in any of our cable at Vandenberg. An extensive analysis and test effort has been undertaken to isolate the source of this moisture. The problem was found in only the last 12 feet of 1,500 foot cable length stored on reels, and then only in isolated cases. The cause is believed to be due to moisture migrating from the end of any unprotected cable end during storage. A thorough search was made of all such cable not yet installed. The cables were shortened to eliminate any suspect ends. The potentially affected cable that was already installed has been tested for moisture. Only one of the approximately 500 cables was suspect and it was replace. The impact of the moisture would not have affected the safety or success of a launch operation. This is another example of a problem being identified, tracked and solved by our normal problem identification and resolution process. Our corrective action began in April 1984.

The NBC news report then mentioned some "cracked welds on piping valves . . ."

In early June 1984, during preparation for the installation of certain valve assemblies, our inspectors found some cracked welds and contamination on valve seats. Weld problems were noted on 14 of 49 valves. A formal quality problem correction report was opened on June 13, 1984. All the valves were returned to the vendor for re-work and cleaning. This re-work and cleaning will be completed this month. This is yet another example of our system's ability to identify problems and to implement action to fix them prior to the use of components in key tests or launch processing.

An allegation of a more serious nature was that, "An Air Force investigation concluded last month the defective welds had gone undetected for over a year."

Welding stainless steel is a difficult task, and a rejection rate of about 10 percent is normal in an environment like Vandenberg. At the launch pad at Vandenberg there were 8,000 welds ranging from pipes of less than an inch diameter to about 16 inches. Thus, we would expect perhaps 800 of those welds to be defective, and require rewelding. The Fact is, about 700 of the welds were defective. So what was the problem?

The problem was documentation! Each of the welds must be verified through a radiograph, or X-ray picture, which will reveal any cracks or gaps. The subcontractor's problem was that the traceability of his radiographs back to the specific welds did not permit us to positively identify which welds were good and which were bad on 3,000 of 8,000 welds.

Thus, a complete review of the weld documentation confirmed that of the 8,000 welds in question, 5,000 were good. The remaining 3,000 were re-x-rayed and less than 700 required re-work.

The subcontractor who did the welds and performed the radiographs started welding in May of 1983. Martin Marietta, the prime contractor at vandenberg, examined the first of the radiographs in late December 1983. At that time, our contractor and Government personnel first questioned the ability of the Martin subcontractor to successfully complete his subcontract. In March 1984, we recognized that the weld traceability documentation problem was severe and that firm action was required to insure that our weld integrity was adequate. Martin's initial approach, with Government agreement, was to assist the small business subcontractor to resolve the problem. Contractual arrangements were changed in April 1984, to permit additional Martin and Government engineers, managers and inspectors to work on the problem. Because the subcontractor performance did not improve sufficiently, Martin

terminated this contract on May 9, 1984 and immediately hired another subcontractor to complete the work.

All 700 defective welds have been corrected, inspected and certified acceptable by a detailed 100% inspection certification system. As part of this problem resolution we conducted a thorough review of our welding specifications to insure that they were adequate. In this review, cyrogenic experts from NASA, the Air Force, the Aerospace Corporation and the Martin Marietta Corporation have independently verified the adequacy of the specification. The welding problem is resolved and we will be back on schedule by October 1984.

Another serious allegation was that, "Haste to get the job done is encouraged by this contract amendment in which the Air Force pushed the schedule first, the specifications fourth."

Our DOD acquisition regulations provide specific guidelines on how to prepare contracts. A provision called the "order of precedence" is use on DOD contracts to establish the legal precedence among various parts of the contract. The word schedule in the contract clause highlighted in the NBC report is the first part of the Martin contract. The use of the word schedule here can perhaps best be compared to the use of the terms schedule A, schedule, B, etc., by the IRS in income tax forms. The term "schedule" in the Martin contract specifically means the part of the contract which deals with the business aspects of the contract (prices, etc.). It does not relate in any way to a timetable for work or calendar time. Likewise, specifications highlighted in the TV report does not refer to design specifications but to the contractual conditions and agreements specified. It appears that this is a misinterpretation—by an individual who is not very familiar with specific terminology—of a formal contracting document, written in legal contracting terms.

The essence of program management is the constant balance of cost, performance and schedule. The schedule to activate our shuttle launch facilities at Vandenberg by October 1985 is tight and we're working hard to make it. I believe that our managers at Vandenberg are striking the proper cost/performance/schedule balance.

In the space launch business we have never sacrificed flight safety or mission success for schedule, and we never will.

Another allegation was that, "Last March the Air Force removed the quality assurance division from signing off on the systems. Quality has taken a back seat. Schedule is driving it. Safety is being disregarded."

The Government employs a formal sign-off system for accepting equipment from our contractors. In a normal plant environment where we are accepting equipment for government operation, we assign the responsibility to sign the final document to the quality assurance inspectors who are located in the contractor's plant.

The activation, check-out and operation of the space shuttle launch facilities at Vandenberg pose a different situation. Martin, under contract to the Air Force, is responsible for the design and installation of some 108 systems at Vandenberg. Each of these systems will then be turned over to another contractor, Lockheed, for final testing and for use in processing the shuttle vehicle for launch. This shuttle processing contract with lockheed is a joint NASA-Air Force contract for processing the Shuttle vehicle for launch and provides the Government commonality between our east coast and west coast launch sites.

At Vandenberg, we plan to have the final testing of the launch processing systems to be performed by Lockheed, the contractor who will be operating these systems during pre-launch processing. This arrangement provides two benefits: It gives us additional independence in the testing process and it provides early, hands-on training for our operations contractor.

The Government's role in this process is to accept the various systems from Martin, the design and installation contractor, and transition the system to Lockheed for final testing. Final acceptance by the Government occurs after the system successfully completes the Lockheed testing. Thus, instead of proceeding through acceptance testing and final configuration audit with one contractor as we normally do with hardware accepted for Government operation, at the Vandenberg shuttle site we are accepting a configuration baseline for the systems from one contractor and transitioning them to another contractor for final testing prior to final configuration audit and acceptance. This transition process from one contractor to another placed heavy emphasis on maintaining strict configuration control and required a broad, overall management perspective to insure a smooth, cost effective transition.

In March 1984, we established a system acceptance audit procedure to manage the transition of these 108 systems from Martin to Lockheed.

This procedure used an audit team composed of various disciplines from within the shuttle activation program to ensure that we were properly balancing cost, per-

formance, and shedule. Specifically, membership includes quality assurance, safety, logistics, engineering and configuration management.

Our situation at Vandenberg is a unique one. We, in essence, have our program office and our "factory" for this large, one-of-a-kind system both located at the same place. This allowed us to place the signature authority for the acceptance audit team in the program office configuration management directorate. This signature authority was made contingent upon agreement by all team members—quality assurance, safety, logistics, engineering, and configuration management—on the acceptability of the system. Formal certification sheets were developed to document the system's conformance to technical documentation. This certification sheet is signed by all team members prior to audit acceptance signature. Formal quality assurance sign-off is not abrogated by this method of acceptance. Quality assurance is fully represented along with other disciplines in every facet of this process.

I believe that this is an example of strengthening our overall management of a complex, one-of-a-kind system by taking advantage of the co-location of the management personnel at a single site.

Another allegation stated that, "Martin Marietta Company pressurized an 8-inch water hydraulic line marked 'Do Not Pressurize! . . .' resulting in water damage that cracked the launch pad."

We are currently in the process at Vandenberg of transitioning from a construction type environment to a more vigorous aerospace environment for the installation, check-out and operation of the various processing systems. Detailed procedures are being developed and verified for every operation on the launch pad area. These written procedures, similar to checklists used by pilots, will control the operation of every valve, and each system on the pad.

The procedures (operating instructions) are subject to change to accommodate specific day-to-day activities needed to keep the activation of a large, complex facility on track.

The waterline which was pressurized should have had an "Out of Service" tag on it and the procedure for its operation should also have been annotated, since this line had been intentionally taken out of service some months previously to close an open underground outlet. At the time of the incident, however, no tag was in place to alert to operator that it was out of service. The resulting underground water flow cracked a 4-inch slab of concrete which had been laid to control post-launch water runoff. The cracked concrete is not part of the launch mount, or pad, structure. It is similar to a concrete patio. If repairs are required, they will be minor and will not impact other work on the launch pad area. The process of controlling out of service systems and similar equipment that is transitioning from construction to operations has been reviewed as a result of this incident and more strict procedures have been implemented to prevent a similar incident in the future. The first action taken was to place an out of service tag on the valve. This action was taken immediately and led to the inspector's report that the tag was in place before the incident. In fact, it was put in place after the incident and before the inspector's write-up.

The last of the allegations was that, "every time the quality assurance specialist approached a welding booth area, the Bechtel personnel disappeared."

Government inspection of in-process work of a prime's subcontract is allowed in contractual agreements with our contractors. It is not unusual for an employee who is engaged in a hazardous skill, like welding, to stop when unknown or unrecognized people are in his work area. The normal procedure is for the prime to notify the subcontractor that Government inspectors will be inspecting his work. This notification is generally done informally by on-site employees and is consistent with good safety practices.

In this particular instance cited—the only known occurrence, by the way—an Air Force quality assurance specialist not known in the area was assigned to walk through the area for surveillance of the prime contractor, Martin. The welders incorrectly assumed that the Air Force was conducting an inspection without advance coordination. Action is being taken by the Air Force and Martin to insure proper communication in the future.

These were the allegations made, and the results of my investigation of each one. I am satisfied that the program is going well, but let me assure you that this subject will continue to receive my personal attention.

Finally, let me say that the Air Force appreciates the quality assurance personnel at Vandenberg Air Force Base, and throughout the Air Force and the difficult, but essential, job that they do. We are concerned about the frustration level that must have existed in these individuals who felt they must go to NBC to get their views heard as opposed to using the existing system to resolve their concerns.

Let me emphasize that we are not interested in who these individuals were but we are very interested in ensuring that our existing management system is working promptly and effectively to resolve the problems we have identified.

The Air Force Inspector General has completed a detailed investigation which uncovered no additional major findings.

However, both reviews did uncover some concerns that need to be resolved at Vendenberg. Those included the number of quality assurance personnel on site and communications between our quality assurance personnel and site activation managers. We are taking steps to solve these problems.

In summary, let me say, we have a tough challenge at Vandenberg, but I believe we have the management procedures in place to complete the job successfully and safely.

This concludes my formal statement, Mr. Chairman. I will be pleased to address any questions the Committee might have.

[The following information was subsequently received for the record:]

## Questions of the Minority and the Answers Thereto

### VANDENBERG POWER SUPPLY UNITS

*Question.* Mr. Aldridge, before I begin my questioning, let me indicate that I was both pleased and impressed with the efficient and timely manner in which the Air Force responded to the accusations levied by NBC News. You are to be complimented for making a deliberate effort to assess the damage and advise the Members of Congress and the public as to the extent of the charges. Seldom, if ever, does a Federal agency have its Inspector General and Under Secretary so quickly involved in an investigation.

Mr. Aldridge, you responded to a series of accusations today. There is one, however, that is omitted from your testimony and that was not mentioned by the wire services until August 30, 1984.

Would you please tell the Committee what the "power supply units" are at the Vandenberg complex and whether or not 9 of 16 of these units had to be replaced?

Answer. The power supply units are off-the-shelf hardware manufactured by the Sorenson Company of New Hampshire. The power supplies provide regulated electrical power to payload systems. Twenty-six units have been delivered, twenty-four for installation and two spares.

During initial power-up and testing of the units, nine of sixteen installed units, failed with various discrepancies. Eight units were returned to Sorenson for analysis and repair, of which three have been repaired and returned. One unit was repaired on site. To date, no additional units have failed.

### ACTIONS TO IMPROVE QUALITY CONTROL MORALE

*Question.* As I indicated in my opening statement, the thing that most concerned me when I heard the accusations was the fact they were levied by quality control personnel at the site.

Would you please indicate what steps are being taken to improve morale within the quality control group? Will additional quality control personnel be hired by Martin Marietta and the Air Force? Is there any truth to the contention that prior to the release of this story a request for additional quality control personnel was rejected by the Air Force but that Martin Marietta subsequently assigned several engineers to the quality group?

Answer. In mid 1982 the Air Force recognized the need for additional Quality Assurance manning at Vandenberg. As the workload continued to increase, Vandenberg requested and received authority to use temporary duty inspectors to assist permanent inspectors. Sixteen inspectors were provided from Air Force resources. Additionally, Vandenberg trained 30 Air Force engineers to supplement the quality force. Prior to the 20 Aug 1984 allegation, 41 additional positions were authorized, and they are now being filled. Martin Marietta, during the period from approximately June to August 1984, increased their quality control force at the site by 30 personnel.

Additional action taken includes providing an orientation program to temporary and new permanent Quality Assurance personnel in the nature, scope and direction of the program. Additional emphasis is being placed on the involvement and visibility of quality management and improvement of communicating management deci-

sion rationale, team relationship, overall visibility and recognition of personnel and quality concerns.

PROBLEMS WITH SMALL BUSINESS CONTRACTOR AT VAFB

*Question.* In your testimony you discuss in some detail the problems that were encountered by the small business contractor who did the welding on this project and the efforts that were made by the prime contractor and the Air Force to try and assist this subcontractor.

Is there any truth to the allegation the welding subcontractor actually lost the log book in which welds that required reworking were catalogued? Is it true that the subcontractor was given a "cost plus contract" in lieu of the original "fixed fee" contract to provide for more detailed inspection of the welding and to ensure a higher level quality control? Why did this contractual change not lead to improvements? Are there currrently any small business contractors left on the Vandenberg complex site? What subcontracts are they responsible for?

Answer. The welding subcontractor kept two weld rework status logs, manual and automated. Due to poor process control technique, the subcontractor's record keeping methods (actual versus recorded data) were suspect. The log book was not lost; however, the data was of such poor quality that the book was useless. Therefore, Martin reexamined all welds on the contract and appropriately dispositioned them. A new weld audit trail was established and recorded.

Martin restructured the type of contract they had with their subcontractor in an attempt to gain more positive control of the subcontractor's process control methods, work prioritization, workmanship, responsiveness to schedule commitments, and improve performance. This was the final in a series of actions taken to improve overall performance. The subcontractor could not or would not improve the performance of his organization, became less responsive and failed to produce an integrated plan to complete the job. His contract was subsequently terminated by Martin.

The following are the small business contractors on the Vandenberg launch complex:

Air Force contractors name and description:

Santa Maria Electric, ice suppression system; B.D. Collins, tank checkout facility, B.D. Collins, ice suppression system; B.D. Collins, solid rocket booster hold down posts; Scott Co., GOX vent arm installation; Scott Co., environmental control system; and Aircraft Engineering, payload ground handling mechanism.

## CORPS OF ENGINEERS CONTRACTORS

| Prime contractor | Subcontractor | Description |
|---|---|---|
| Pacific Mechanical Corp | Ericon | Ice suppression systems. |
| | Searl | |
| Jameson | Welch Survey | Evaporation pond. |
| | Spies Construction | |
| | A.J. Diani | |
| Marcon Construction | American Coatings | |
| | Collins Electrical | |
| | A.J. Diani | |
| | Hartley Mech., Inc | |
| | San Luis Tank and Piping | |
| Murphy Industry Coating | | Mobile service tower painting. |
| Line Power | | GN2 power plant. |
| Bay Area Crane | | Orbiter service platform. |
| A.J. Diani | Ken Smith Masonry | Security modifications. |
| | Santa Maria Acoustical | |
| | Devcon System Corp | |
| | Harold Well | |
| | R.P. Richards | |
| | M.R. Hartman | |
| A.J. Diani | American Coatings | Facility modifications. |
| | Ericon | |
| | Hydroelectric | |
| | R.P. Richards | |
| | Santa Maria Electric | |
| | Elevator Industries | |

PREVIOUS HISTORY OF SPACE SHUTTLE LAUNCH SITE AT VAFB

*Question.* In addressing the problems that you have encountered at the Vandenberg site, you did not give the Committee a good idea of the nature of the site.

Isn't the shuttle pad being constructed at the old manned orbiting lab pad approximately 15–20 years old? Isn't there a sutstantial degree of old plumbing and piping in that area? Won't contamination problems continue to be a problem in the future because of the nature of the Vandenberg site?

Answer. Construction of the shuttle pad is taking place at the Manned Orbiting Lab (MOL) site. Construction of the MOL pad was initiated in 1966 and was terminated in 1969. At the point of termination, a significant amount of facilities work had been completed, including some underground piping for water and drainage. However, no piping for commodities used in direct launch support had been installed. In the construction of the Shuttle pad, approximately 81,400 feet of piping is being installed for commodities used in direct launch support. This is all new piping installation. To accommodate the various facility needs at the pad, approximately 12,600 feet of piping were required. Of this amount, less than 25 percent of MOL facilities piping was used.

To summarize, 96.6 percent of all piping installations at the shuttle pad are new construction. Protection of both new and old underground piping from corrosion is being accomplished through an active cathodic protection system installed throughout the pad complex.

Contamination of hardware during construction, initial system installation and subsequent removal, repair or replacement operations is a continuing problem. Miles of pipe, adverse environment, multiple contractors and some old systems present a real challenge. However, this problem was recognized and mitigation can be accomplished by isolating the operation from the weather conditions prevailing at Vandenberg. This isolation can be as little as a polyethylene drape or as complex as the building of a portable, habitable clean room depending upon the contamination sensitivity of the system. A stringent cleaning process is undertaken that ultimately verifies cleanliness of the systems.

The effectiveness of these procedures in isolating and cleaning the systems from the VAFB environment have been amply demonstrated over the past 19 years at the Titan Launch Complex.

SPACE SHUTTLE LAUNCH RATE AT VANDENBERG

*Question.* In the 1970's the Pentagon estimated that there would be an average of four shuttle launchings a year from Vandenberg. The latest projection, however, is for a total of only four flights through 1989.

Would you please give us an indication of what has caused this dramatic reduction in the number of proposed launches? Is more activity taking place at the Kennedy facility than was originally planned, or are there fewer Defense-related launches?

*Answer.* In 1976 the DOD Shuttle Mission Model for Vandenberg AFB was:

| Fiscal year: | |
|---|---|
| 1986 | 5 |
| 1987 | 3 |
| 1988 | 6 |
| 1989 | 5 |
| 1990 | 3 |
| Total | 22 |

The FY 85 President's Budget Mission Model for Vandenberg AFB is:

| Fiscal year: | |
|---|---|
| 1986 | 2 |
| 1987 | 0 |
| 1988 | 3 |
| 1989 | 3 |
| 1990 | 6 |
| Total | 14 |

No more activity is taking place at the Kennedy facility than was originally planned. There are eight fewer shuttle launches because of two decisions. In 1980, the Air Force decided to fly four DMSP satellites on refurbished Atlas E boosters through FY 89. In addition, four other flights were eliminated when program

X0760–05 was not funded. Other than the flights mentioned above, the DOD Shuttle flight requirements at Vandenberg have remained constant.

MAJOR FINDINGS REGARDING VANDENBERG AFB SPACE SHUTTLE

*Question.* Could you please provide for the record at list of the major findings that you uncovered, as well as a copy of the Inspector General's report?

Answer. List of major findings:

A. There is no substance to any of the allegations that the launch pad will blow up when the shuttle is launched from Vandenberg next year.

B. There is no fundamental problem of safety or quality assurance at Vandenberg which would prohibit us from successfully and safety launching the shuttle.

C. Although problems with welds were uncovered by Martin Marietta and Air Force quality assurance personnel, these problems should have been detected and resolved earlier.

D. The problem with welds stemmed from an inadequate tracing and documentation system which resulted in a situation wherein the integrity of individual welds could not be positively verified. The number of actual inadequate welds fell within acceptable industry standards.

E. There were an insufficient number of quality assurance personnel to provide complete and through oversight of a project as large as the Vandenberg space shuttle launch facility.

F. The communication lines between management, quality assurance and contractor functions were insufficiently developed to provide accurate and timely information flow.

A copy of the Inspector General's report has been provided under separate cover.

*Question.* To what extent did the Inspector General uncover additional quality control concerns?

Answer. The Inspector General took a detailed look at the quality program. He found that there was a lack of good communication between program management and a significant portion of the quality assurance work force, and that management had not adapted an efficient Air Force quality assurance program to fit the activation portion of the shuttle project.

*Question.* Were these discrepancies detected as a result of your investigation, or had the prime contractor and the quality control personnel at the site already made these findings?

Answer. Every one of the technical discrepancies had already been found by either contractor or quality assurance personnel at the site prior to our investigation.

*Question.* Had remedial action been initiated to correct all of the known discrepancies?

Answer. Yes. In fact, the welding and electrical wiring problems had essentially been resolved before my investigation.

*Question.* Will the investigation of the Vandenberg complex continue, or in the opinion of the Air Force is the situation in control?

Answer. We believe that the situation is under control; however, we intend to continue to monitor the progress of the space shuttle program. The Inspector General's report contained recommendations to correct the noted problem areas and was forwarded to Air Force Systems Command for action. The corrective actions taken and the results will be briefed to the Secretary of the Air Force at the next Secretarial Program Review in December.

VANDENBERG SPACE SHUTTLE LAUNCH COMPLEX BACKGROUND

*Question.* Martin Marietta is the prime contractor for the Vandenberg complex and has been active at the Vandenberg Air Force Base for quite some time on a variety of projects.

Would you please give the Committee an assessment of Martin Marietta's track record on other major projects undertaken for the Air Force? To what extent has Martin Marietta been able to attract Rockwell personnel who assisted with the construction of the shuttle complex at the Kennedy Space Center? What are the major differences and technical challenges between the VAFB and JSC shuttle pads?

Answer. The other major contracts that Martin Marietta has undertaken for the Air Force are the Peacekeeper missile, the Titan ICBM, and the Titan Expendable Launch Vehicle used for satellite launches. Martin has performed very well on these contracts. The Peacekeeper has had five successful launches and cost performance has been acceptable. The Titan program has been an outstanding success both technically and costwise throughout its history. Martin has built five different ver-

sions of the Titan Expendable Launch Vehicle for the Air Force and has provided launch and engineering support services to the Air Force at both Vandenberg AFB and Cape Canaveral AFS for almost twenty years with a superb record in both safety and success. The 300th Titan launch occurred in August 1984 with Martin Marietta support.

Martin Marietta has subcontracted the development of the Orbiter related software to Rockwell. Martin Marietta has not attracted Rockwell personnel; however, the Air Force has a separate contract with Rockwell to provide the same assistance during construction and equipment installation at Vandenberg as they provided to NASA at the Kennedy Space Center (KSC).

The major differences and technical challenges between Vandenberg and KSC are mainly in the concept of operations, facility and starting point areas. At KSC the concept of operations is to integrate the components of the Shuttle (Orbiter, External Tank, Solid Rocket Boosters and some payloads) on the Mobile Launch Platform (MLP) and then transport the entire assembly to the launch pad. This concept allows for a relatively high launch rate because the launch pad is utilized for the minimum amount of time. At Vandenberg the concept allows for a relatively high launch rate because the launch pad is utilized for the minimum amount of time. At Vandenberg the concept of operations is to build the Shuttle components up on the pad and then launch the vehicle. Since more activity takes place on the launch pad, the number of flights achievable is limited. This is acceptable at Vandenberg because we anticipate launch rates about ⅓ of those at KSC.

The facilities at Vandenberg are quite different from those at KSX because of the concept of operations, climactic considerations and payload processing. The big difference is in the launch complex area itself. At Vandenberg the launch complex was a major modification to the existing Manned Orbiting Laboratory cancellation of the MOL program in 1969 and were designed for a much smaller and less complex vehicle than the Space Shuttle. At KSC the launch pad and MLP were used on the Apollo for their Saturn booster. Although extensive modifications to the launch complex and MLP were required, they were considerably less than those at Vandenberg. Additionally, Vandenberg experiences fog, wind and temperature changes that are more severe and more of a factor in the design of the facilities. Finally, the payload processing facilities at Vandenberg are located on the launch pad itself rather than at a separate location as they are at KSC. These are the major differences between the two launch sites. The technical challenges presented by both are enormous; however, there is no new technology going into the Vandenberg launch site. The challenge is to integrate the 200,000 pieces of support equipment into a system that will successfully support Shuttle launches from Vandenberg.

Senator GORTON. We will now hear from Mr. Beggs.

## STATEMENT OF HON. JAMES M. BEGGS, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. BEGGS. Good morning, Mr. Chairman. I welcome the opportunity to testify before you this morning on the space shuttle launch complex at Vandenberg Air Force Base.

As you are well aware, the goal that we have at NASA is to make the space transportation system fully operational and cost effective in providing the routine access to space for all users. Our primary concern and objective is that each mission is safe and successful. As the Aerospace Safety Advisory Panel reported to Congress, our safety record has been 100 percent so far, and the shuttle has performed superbly during each mission. May I add here, Mr. Chairman, this last mission was particularly satisfying in that regard. We were very pleased with the esult.

The program includes supporting the activation of the Vandenberg Air Force Base launch facility. While the acquisition, activation and operation of Vandenberg as an STS launch and landing site is the responsibility of the Air Force, NASA has been and is continuing to provide assistance based on our experience in activating the Kennedy Space Center launch and landing facilities. The Air Force, as Mr. Aldridge noted, has appointed an investigative

team to look into the allegations surrounding the construction and quality control activities at Vandenberg, and NASA will provide assistance to the Air Force as requested.

It is our opinion, based upon observations of NASA personnel located at Vandenberg, that there has not been an unusual number of quality problems for a project of this complexity and magnitude, and that the Air Force quality program has been effective and has identified and documented the alleged problems. While we foresee no impact on the space shuttle program on the present or future, any delay in the activation at Vandenberg would delay the DOD planned STS launches from Vandenberg. NASA has no planned civilian launches from Vandenberg until 1987, so we have no scheduling problems as such.

Mr. Chairman, that concludes my brief remarks on the Vandenberg situation. I would be pleased to respond to questions.

Senator GORTON. Mr. Administrator, in your opinion have the quality control methodology and procedures of Vandenberg shuttle project been adequate and appropriate?

Mr. BEGGS. Yes, sir. The system that the Air Force employs is a little different than the system NASA employs, but generally speaking the approach is the same. They do it the same way.

It has been our experience, both at Kennedy and in general throughout my career, that weld problems, which are the ones that have been most frequently cited with respect to Vandenberg, are something that you can normally expect. When welding under conditions which are largely in the open during construction, you could anticipate that you will have 5 to 10 percent defective welds, occlusions, cracks, and so forth, and that is the reason you do require radiographic analysis of those welds in the field.

Senator GORTON. Has the Air Force adequately called upon the experience of NASA at Kennedy during the course of this project, in your view?

Mr. BEGGS. I think they are now, yes. I think they have been for the last 2 or 3 years. As Mr. Aldridge mentioned, when they slipped the original date, they asked for more help. We gave that help willingly and readily, because we felt that it was something we had to support in order to assist in every way to solve schedule problems.

So, at any given time at Vandenberg, we have had upwards of 30 NASA people. In the past year, we sent Mr. George Page, who is one of our most experienced managers at Kennedy, out to Vandenberg and he has been there more or less full time.

Senator GORTON. Were there discrepancies of the number, nature, and seriousness of those which have been discussed here during the course of the construction at Kennedy?

Mr. BEGGS. Yes. Not quite the number, but certainly there were serious problems at Kennedy during the construction phase. We did have some electrical problems and we had weld problems, not to the same degree. But you must remember that at Kennedy we had been through this process a couple of times during the Apollo program, and that legacy carried through into the shuttle program. The personnel were the same; the contractor personnel to a large extent were basically the same. That is, many of the Rockwell people who were on the job at Kennedy had served during the

Apollo days. So they were familiar with, and I think were better able to stay ahead of some of those problems

With all that, we had 2 or 3 percent bad welds, occlusions, cracks and so forth, which had to be repaired. We did have some major electrical problems on the mobile launch platforms, cabling problems, and electrical problems which had to be corrected, as well as some problems in the plumbing and the activation itself of the launch pad. We have had, I might add, problems of that sort both on pad A and pad B.

Senator GORTON. To what extent, if at all, is there an overlap of contractor personnel from any of the work at Kennedy now out at Vandenberg?

Mr. BEGGS. The Martin people have been active, both at Kennedy and Vandenberg, as have a number of the Rockwell people. With the advent of the shuttle processing contract, we have aggregated a number of functions into a single contract, that activity will serve both Kennedy and Vandenberg. That activity is just coming into operation. But it will more and more be the way in which we will be operating at both sites in the future.

Senator GORTON. Do you have any doubts that the Vandenberg shuttle project will be able safely to support its initial mission in October of next year?

Mr. BEGGS. My assessment is that it is going to be tight, Mr. Chairman. But I have to take the Air Force assessment on its face value, and that is that they expect to make the October date.

We, in NASA, on our part of it, to supply the shuttle hardware that is necessary, are taking that date very seriously and expect to have the shuttle and shuttle hardware available by October. But it is a tight date. I think that Secretary Aldridge noted that in his statement they are putting increased attention on the question of the slack time that is in that schedule.

Senator GORTON. Is it your view and policy that that date will be slipped or postponed if there are any significant safety problems in connection with meeting it?

Mr. BEGGS. Oh, yes. I do not think there is any question about it. They follow the same procedures that we do in assessing the safety of the launch, and should there be a safety problem or a problem with respect to the functions not being completely available, we will not fly. NASA will be a part of that decision. There is just no question that together we will not fly if it is not completely ready.

Senator GORTON. As of today, is it accurate to say that you do not have doubts or questions about aspects of the Vandenberg shuttle launch and landing site, whether it is in the field of management, construction, quality control, or safety?

Mr. BEGGS. Yes, sir, I think that is a fair assessment. I have been out there and walked the site myself. As I noted previously, we have had upwards of 30 NASA people. And I talked with George Page from time-to-time to get his assessment, and I do believe that it is as has been stated.

Senator GORTON. Mr. Beggs, I am going to digress for a moment, while I have you here, and ask you about the upcoming shuttle schedule for the next year. You plan approximately one shuttle launch per month from Kennedy, and I would like to know how confident you are that this schedule can be achieved and whether,

if you are forced to scrub a mission for one reason or another, you can combine two missions into one, as you did on this most recent one.

Mr. BEGGS. Yes. Thank you, Mr. Chairman. In view of the problems we have had this year, most particularly the upper stage problems, I think it would be foolhardy to say that we cannot run into problems again of that type. However, the major problems that we have had, those nozzle problems on the upper stages and the main engine problems we have run into in this past year, I think are to a large extent behind us.

We could have, of course, flown this latest mission earlier if we wanted, but we did combine the two missions, as you noted. And, we can do that in the future. It is possible to combine missions, providing that we have capacity available; and, in most of the flights that are booked, they are not booked 100 percent.

As you know, we had set a policy of trying for about a 70- to 75-percent load factor when flying. We have done pretty well in coming close to that. But, that means if we do have a problem in any one of those monthly flights we can rebook and fly.

We do not like to do that, for the simple reason that it causes problems for some of our customers when we cancel a flight. Most of the folks who are flying communications satellites on board are very anxious to have those put into operation, because their revenue stream starts as soon as they can supply the service. So, we are going to try to hold that schedule and I think we have a good chance of holding the schedule. We are turning the vehicles around, I believe, in good time, and each time we turn them around we are realizing some gains in the learning curve process of improving our process.

We will have, of course, Columbia back in February of next year, and we will plan to fly Columbia again in May or so of 1985. And then we will get the fourth orbiter, Atlantis, in late April or early May of 1985, and we will plan to fly that in September.

Senator GORTON. Are both of those proposed launches on schedule?

Mr. BEGGS. Excuse me, sir?

Senator GORTON. Are both of those proposed launches, May 1985 for Columbia and November for Atlantis, on schedule at the present time?

Mr. BEGGS. Yes; they are on schedule, as is the upcoming launch of the Challenger, which will take place early in October. We have not fixed on a specific date. It has been stated publicly that it will be the 1st of October, but we have not fixed the date, whether it could be the 1st, 2d, or 3d. But, it will be very early in October, and we are schedule on that.

Senator GORTON. Can you give us the latest information on negotiations to retrieve the Palapa B-2 and Westar 6 satellites during the November shuttle mission?

Mr. BEGGS. Yes, sir. We have not completely signed the contracts, but I believe we have reached agreement in principle, with the Indonesian Government, Western Union, and with their underwriters, to go and retrieve those satellites. It remains now to sit down and draw up the contracts that will be necessary to do that.

Senator GORTON. What do you estimate your chance of success to be? What kind of technological and logistical considerations are there to picking them up?

Mr. BEGGS. There is no real problem that we see in getting the satellites into a proper orbit and rendezvousing with them. The problem is an engineering one, designing a proper fixture to grapple the satellite without damaging it, and then, of course, designing a proper cradle to set it in the shuttle and bring it back.

We are well underway in that engineering work. What we intend to do is design a fixture that will essentially go into the nozzle of the apogee motor, which is still attached, and, in essence, have a fixture that will expand or hold the nozzle and that will give you a good hold on the satellite.

We will have to test that fixture on the ground. We will be doing that in the coming few months.

Senator GORTON. Will this be accomplished entirely from within the satellite, or will you have astronauts outside manually helping to do this?

Mr. BEGGS. If we think we can do it with the arm, we are going to do it with the arm. But we have not fully arrived at that conclusion. As you know, we learned a lot in the Solar Max Retrieval mission on what we could do with the arm. At the time that we made that retrieval, we were not sure that we could make a grapple and bring it aboard with the arm alone. But now that we have done it once, we have a lot more confidence that we can use the arm to make that kind of retrieval I think that we will try to do that with these communications satellites.

But again, we have not fully tested that process and we will have to do that. And if it requires an EVA, we will use an EVA. The astronauts are very confident of that procedure as well.

Senator GORTON. Are those two satellites a long way from one another? Is there any problem in, assuming that if one retrieval is successful, in getting to the location of the other?

Mr. BEGGS. They are a significant distance apart. But it does look from the studies that we have done that we can rendezvous with each one in succession on a single mission. We can put them into a similar orbit and with the maneuvering capability we have with the shuttle we can get them both. They are, of course, both in the same inclination, which is very important. We will, we believe, be able to get them both at about the same altitude by the use of the OMS engines. And once that is done, then rendezvousing with them in succession should be relatively straightforward.

Senator GORTON. In addition to simply the technological feat of retrieving those two satellites, what would you describe the value, monetary or otherwise, of retrieving them and bringing them back to Earth, and I presume launching them at some future date?

Does it mean that their missions can be entered into more rapidly? Is it strictly a saving of money? If so, how much?

Mr. BEGGS. The satellites, themselves, would be worth on the order of $40 or $50 million, if you were to go out to buy one.

Senator GORTON. Together?

Mr. BEGGS. Each.

The question is whether they can sell them in effect as a new satellites. Our belief is that they are in mint condition, that they

could be relaunched. But they would have to go through the system tests and the ground tests to assure that they are in good condition. And then, of course, you would have to find a buyer for them, because both Western Union and the Indonesian Government have purchased a new satellite to replace those. So, it would require the finding of a buyer and his willingness, of course, to accept a satellite, after it has been tested, as a new satellite, in order for them to have the value I cited.

The value ranges everywhere from that as a high point down to salvage, that is, the value of the pieces and parts, and that is somewhere between $8 and $10 million for each one. So they have significant value in salvage. But of course, if you could sell them as new communications satellites to be put in orbit, they would have the value of a new satellite.

Senator GORTON. Who owns them at this point?

Mr. BEGGS. I do not think they have decided. I think they are still trying to decide who the proper owner is. Of course, the underwriters have a definite stake, in that they have paid off at least part of the claim. I think the major part of the claim, both in the case of the Indonesian and Western Union question, has been paid, but not all of it, however. So, it will be a negotiation between the underwriters and the original owners of the satellite as to who gets what from the salvage value of the satellites, what they are worth.

Senator GORTON. Mr. Beggs, I should like to thank you for your testimony and your reassurances here today. And for both you and for the previous panel, there will be a statement in the record from the ranking minority member, Senator Heflin, and some questions from him which we will ask both you and the previous panel to answer.

Mr. BEGGS. Thank you, Mr. Chairman.

[The following information was subsequently received for the record:]

QUESTIONS OF THE MINORITY AND THE ANSWERS THERETO

*Question.* From the perspective of NASA, I would assume that the most important issue to be resolved is whether or not safe and timely launches can be launched from the Vandenberg facility?

Answer. Safety is always a top priority item for NASA and as the overall Space Transportation System (STS) Manager, NASA will insure the safety of launches from Vandenberg in the same manner and degree as it does from Kennedy Space Center. The Air Force is committed to having Vandenberg ready for an October 1985 STS launch and NASA planning supports that date. The Air Force also maintains that it will not launch from VAFB until the systems are checked out completely.

*Question.* Who has the final say as to whether or not the Vandenberg Complex is operational—NASA or the Air Force? Who has the final word on whether or not Space Shuttle Discovery is launched in October 1985?

Answer. The operational status of Vandenberg will be a joint decision between NASA and the Air Force. The Air Force is responsible for the acquisition, activation, and operation of Vandenberg but NASA will participate in the certification of Vandenberg being ready for launch. The decision on whether the Space Shuttle Discovery is launched in October 1985 will also be a joint decision by NASA and the Air Force. It will be accomplished through a series of reviews where each element of the STS must certify a readiness for launch.

*Question.* Based on your experience, how likely is a launch at the Vandenberg Complex in October 1985? Would a delay have any implication for the first scheduled civilian launch—The proposed Landsat rescue mission in 1986?

Answer. Based on Air Force data and schedules, the schedules for readying Vandenberg for an October 1985 launch are highly success oriented but achievable. A significant delay could pose a potential schedule risk for the second DOD launch although it is not planned to be launched before September, 1986. The proposed Landsat repair mission is tentatively scheduled in January 1987, and should not be particularly sensitive to a delay in the October 1985 IOC.

*Question.* What is the exact nature of the reimbursement arrangement that will exist between NASA and the Air Force as regards the use and operation of the VAFB Space Shuttle Complex and NASA's provision of the Space Shuttles.

Answer. NASA provides standard flight operations support services for all flights, including analytical integration, physical integration, mission/flight operations, and post-flight operations. DOD pays NASA for materials and services for all flights regardless of launch site. Materials and services exclude the cost of flight operations for KSC launch costs. In return, NASA does not pay DOD Shuttle-related VAFB launch costs supporting a civil launch. Additional efforts beyond the organic capability necessary to support standard services will be provided at additive costs by the requesting agency.

Senator GORTON. This meeting is adjourned.

[Whereupon, at 10:23 a.m., the subcommittee was adjourned, to reconvene upon the call of the Chair.]

○